

(19)日本国特許庁(JP)

(12) 公開特許公報(A)

(11)特許出願公開番号

特開平5-148658

(43)公開日 平成5年(1993)6月15日

(51)Int.Cl. <sup>5</sup>	識別記号	庁内整理番号	FI	技術表示箇所
C 2 3 C 18/18				
18/31		Z		
H 0 1 L 21/60	3 1 1	W 6918-4M		
// H 0 5 K 3/24		A 6736-4E		

審査請求 未請求 請求項の数5(全 5 頁)

(21)出願番号 特願平3-334454

(22)出願日 平成3年(1991)11月22日

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(54)【発明の名称】 無電解錫めっき方法

(57)【要約】

【目的】 銅を被めっき物とする無電解錫めっき処理を行なうに際して、形成された錫めっきにおけるホイスカーの発生を完全に抑制し得るような無電解錫めっき方法を提供することを目的とする。

【構成】 銅を被めっき物としてこれに無電解錫めっきを施すに際し、酸、過酸化剤および有機高分子化合物の混合液で被めっき物表面を処理した後に無電解めっき処理を行なうことを特徴とする。

## 【特許請求の範囲】

【請求項1】 銅を被めつき物として、無電解錫めつきを施す工程において、酸、過酸化物および有機高分子化合物の混合液で被めつき物表面を処理した後に無電解めつき処理を行なうことを特徴とする無電解錫めつき方法。

【請求項2】 被めつき物を無電解めつき処理した後、さらにアニーリング処理を施す請求項1記載の無電解錫めつき方法。

【請求項3】 酸として硫酸、塩酸、硝酸および磷酸のうちの一種または二種以上を含む溶液を用いる請求項1または2記載の無電解錫めつき方法。

【請求項4】 過酸化物として過硫酸アンモニウム、過酸化水素のうちの何れか一方を用いる請求項1または2記載の無電解錫めつき方法。

【請求項5】 有機高分子化合物として硫酸基または磷酸基に、直鎖状炭化水素または環状炭素化合物またはこれらの誘導体が結合した化合物、またはこれらの化合物の塩を用いる請求項1または2記載の無電解錫めつき方法。

## 【発明の詳細な説明】

## 【0001】

【産業上の利用分野】本発明はIC素子の実装に用いられるテープキャリアにおける無電解錫めつき処理技術に関し、特に錫めつき後のめつき面にホイスカーの発生するのを抑制することができるような無電解錫めつき方法を提供するものである。

## 【0002】

【従来の技術】近年、エレクトロニクス産業界においては、低価格、高信頼性を有する多機能装置の開発が急速に進められており、これによる、高機能、高密度素子の出現に伴って、高信頼性、多機能を有し、且つ軽量、薄型の小型デバイスに対する要求が高まってきている。そして、これに伴って新しい素子実装技術開発が日増しに重要性を加えつつあり、特にICパッケージにおける多様化と小型化が重要な課題として開発が進められている。また、このような素子実装技術の進歩によって小型ICパッケージにおける多ピン化の要望に応え得るような微小ピン間隔のテープキャリアの出現が求められている。

【0003】TABはテープ状に形成されたポリイミド樹脂フィルム等の電気絶縁性を有する合成樹脂基板上に多数のボンディング用金属の細密リードパターンを施したものであり、その特徴としては、テストパッドを保有しているのでボンディング後にボンディング不良やチップ不良等の欠陥を実装前に発見することができ、またワイヤーボンディングに比べてICパッドの大きさが小さくて済み、一層の多ピン化を行なうことが可能であるなどその利点が多い。

【0004】現在このTABは、樹脂フィルム上に接着

剤を用いてこれに銅箔を張り合せた構造を有する3層TABが主流であるが、この3層TABではリードをエッチングによって形成するために、高密度実装に不可欠な多ピン化を行なうには限界がある。これに対して近年開発が進められている樹脂フィルム上に直接金属層を形成した2層TABは、リードが電気めつきによって形成されるために多ピン化には有利であるが、リード形成の過程においてレジストを用いたフォトリソグラフィ技術等の光学的技術を応用するために、形成可能なリードピッチはレジストの解像度によるところが大きく、両者ともにエッチング技術、レジスト技術進歩にその性能の良否が委ねられているのが現状である。

【0005】ところで、TABをICチップに実装する方法としては、ICチップに予め形成されたバンパ上にTABのリードを重ね合わせて熱圧着するいわゆるギャグボンディング法が一般的であり、従来リードフレーム等のボンディングに適用されているワイヤーボンディング法に比べて効率がよく、この点においてもTABがICチップの実装に優れているといえることができる。

【0006】ICチップに形成されたバンパは、通常金によって形成されたいためにボンディング強度を上げるためには、TAB側の銅リードにも金めつきを施すのが最適な方法であるが、コスト的な問題から最近では金の代替として錫めつきが用いられている。何となれば錫は金と共晶を形成するため、TABのリードに形成された錫とICチップのバンパの金とを熱圧着した場合に、この部分に共晶合金を生ずるので十分に信頼性のあるボンディング強度が得られるからである。

【0007】銅リード上に錫のめつき皮膜を形成する方法としては、電気めつき方法、無電解めつき方法とがあるが、リードのパターンの接続、めつき厚みのばらつき等の関係から電気めつき方法よりも無電解めつき方法の方が一般的に用いられている。

## 【0008】

【発明が解決しようとする課題】上記したように錫めつきはコスト的、性能的にIC実装用のTAB形成技術の一つとして有用なものであるが、銅上に形成された錫めつき皮膜上には往々にして皮膜にほぼ垂直方向にホイスカーと称する針状突出物（以下、ホイスカーという）が発生する。このホイスカーは一旦発生すると経時的に成長して最大数mmのオーダーにまで成長する。このホイスカーの発生する場所は傾向として被処理物の端部または角部に多く、TABではインナーリードに多く発生する。これからの実装技術においてはさらに多ピン化による高密度化が進み、TABのインナーリードピッチはさらに微細化されて数十μmのオーダーになることが予想されるので、上記したホイスカーの成長によって容易に隣接したリードの短絡による不良品を発生させる可能性が大きい。

【0009】現在のところ、このホイスカーの発生を解

消する適切な方法はなく、めっき液改善の見地からの検討と、めっき後処理方法の見地からの検討とがなされてはいるものの未だ決めてとなる方法が見出されておらず、ホイスカー発生に対する対抗策としては、錫めっき後に加熱処理をするアニーリング法、さらにはこれと低温で保持する方法との併用が行なわれているが、何れにしても、これらの方法は如何にしてホイスカー発生までの潜伏期間を延長するかに絞られており抜本的な対策にはなっていない。

【0010】本発明は、錫めっき処理における上記した問題点を解決し、無電解錫めっき処理を行なうに際して、ホイスカーの発生を完全に抑制し得るような無電解錫めっき方法を提供することを目的とするものである。

【0011】

【課題を解決するための手段】上記の課題を達成するための本発明は、銅を被めっき物としてこれに無電解錫めっきを施すに際し、酸、過酸化物および有機高分子化合物の混合液で被めっき物表面を処理した後に無電解めっき処理を行なうことを特徴とするものである。

【0012】また上記の処理を施した後、さらに被め

【0013】本発明において無電解錫めっき処理に際して用いられる酸としては、硫酸、塩酸、硝酸および燐酸のうちの一種または二種以上を含む溶液であることが好ましく、また過酸化物としては過硫酸アンモニウム、過酸化水素のうちの何れか一方を用いるのが好ましく、さらにまた有機高分子化合物としては硫酸基または燐酸基に、直鎖状炭化水素または環状炭素化合物またはこれらの誘導体が結合した化合物、またはこれらの化合物の塩を用いるのが好ましい。

【0014】

【作用】次に本発明の詳細および作用について説明する。

【0015】無電解めっきの原理は、本来電極電位の関係から銅上には析出することのできない錫を、めっき液中に銅の電極電位を錫の電極電位よりも低下させることができるようなある種の化合物を添加することによって析出可能にするものである。

【0016】この種の化合物としては、チオ尿素が広く用いられている。従って、錫の銅上への析出は置換反応であり、銅の表面状態、微視的な粗さが被着した錫の特性に影響を与えることは十分に考えられる。

【0017】また、錫めっきにおいてホイスカーが発生する原因には諸説があり、現在その本質的な原因は確認されていないが、銅の残留応力によるとする説が最も有力な説である。ホイスカーの生成を抑制する最も簡便で効果の高い方法としては錫めっき後に90～120℃で数時間加熱するアニーリング法が最適であるという見方が多く、上記した残留応力説を裏付ける方法でもある。しかしながら、上記した加熱方法を採用した場合でもホ

イスカー発生を抑制することは可能であっても完全に消滅させることはできない。

【0018】一般的に、ホイスカーの発生しやすい場所

【0019】通常、如何なる湿式めっき方法でも必ずめ

【0020】前処理の機能には被めっき面上に付着して

【0021】無電解錫めっき方法においても例外でなく

【0022】本発明においては、活性化処理用液中に有機高分子化合物を添加することによって、処理後の銅表面の平滑化を図ることに成功したものである。このように活性化処理溶液中に有機高分子化合物を添加することにより銅表面が平滑化するの

【0023】このような作用を示す有機高分子化合物の構造としては、硫酸基または燐酸基等の親水性を有する官能基直鎖状炭素化合物または環状炭素化合物等の疎

水性を有する官能基とを併せ持つ化合物が好ましいことが判った。本発明においては、実際には、活性化処理を施す際に、研磨液として用いる溶液中に上記した有機高分子化合物を溶解させて用いるのであるが、その濃度は重量で数%程度で十分にその効果が得られる。また処理時間については、通常有機高分子化合物を含まない活性化溶液で処理した場合と変わることはないが、実作業に当たっては、処理後の表面状態を確認した上で定めることが最も望ましい。

【0024】またこのようにして平滑化処理を行なった後、さらに鉍酸等による活性化処理を継続して行なっても本発明の効果は変わるものでない。

【0025】また、当然のことであるが無電解錫めっき皮膜形成後100℃付近の温度で基板にアニーリング処理を施すときは本発明の効果を一層促進することができる。

【0026】

【実施例】以下に本発明の実施例について説明する。

#### 実施例1

厚さが50μmのポリイミド樹脂フィルム（東レ・デュポン社製、カプトン200H）の上面に1μmの銅皮膜を形成したものを基体とし、該基体上面にリソグラフィ法と電気めっきによるセミアディティブ法を併用してリード幅100μm、リードスペース幅130μm、リード厚さ30μmの銅による配線回路を形成した2層TABを作成し、これをテストサンプルとした。

【0027】上記サンプルを用いて以下に示す手順で無電解錫めっきを施した。めっき前処理として、先ずマックススクリーンBEG-306（キザイ（株）製）を用いて20℃で20秒間浸漬して脱脂処理を行なった後、純水で1分間洗浄を行ない、引き続き、過硫酸アンモニウム5g/l、硫酸20ml/l、ドデシル硫酸ナトリウム1g/lからなる混合溶液を用いて20℃で20秒間の処理を行なった。

【0028】次に純水で1分間洗浄を行なった後、さらに10容量%硫酸を用いて20℃で20秒間の処理を行ない基体を乾燥させた。

【0029】無電解錫めっき処理として、Tinposi LT-34（シプレー・ファー・イースト社製）を用いて70℃で5分間の処理を行ない、純水で1分間洗浄を行なった。このようにして得られた錫めっき皮膜の厚みは約0.6μmであった。

【0030】上記の手順で得られたサンプルを大気中に放置し、ホイスカーの発生状況を金属顕微鏡（倍率200倍）で観察したところ、60日経過後でもホイスカーの発生は全く観察されなかった。

#### 実施例2

実施例1と同様の手順で2層TABを作成し、テストサンプルとした。

【0031】次に実施例1で用いた化学研磨液で、ドデ

シル硫酸ナトリウムの濃度を0.5g/lに変えた以外は実施例1と同様の手順で無電解錫めっき皮膜を形成した。

【0032】このサンプルについて、ホイスカーの発生状況を実施例1と同様にして観察したところ、60日経過後でもホイスカーの発生は全く観察されなかった。

#### 実施例3

実施例1と同様の手順で2層TABを作成し、テストサンプルとした。

【0033】次に実施例1で用いた化学研磨液で、ドデシル硫酸ナトリウムの濃度を1.5g/lに変えた以外は実施例1と同様の手順で無電解錫めっき皮膜を形成した。

【0034】このサンプルについて、ホイスカーの発生状況を実施例1と同様にして観察したところ、60日経過後でもホイスカーの発生は全く観察されなかった。

#### 実施例4

実施例1と同様の手順で2層TABを作成し、テストサンプルとした。

【0035】次に実施例1で用いた化学研磨液で、ドデシル硫酸ナトリウムに替えて1,5-ナフタレンジスルホン酸2ナトリウムを濃度1g/lで用いた以外は実施例1と同様の手順で無電解錫めっき皮膜を形成した。このサンプルについて、ホイスカーの発生状況を実施例1と同様にして観察したところ、60日経過後でもホイスカーの発生は全く観察されなかった。

#### 実施例5

実施例1と同様の手順で2層TABを作成し、テストサンプルとした。

【0036】次に実施例1で用いた化学研磨液で、ドデシル硫酸ナトリウムに替えて2-ナフチルアミン-1-スルホン酸を濃度1g/lで用いた以外は実施例1と同様の手順で無電解錫めっき皮膜を形成した。このサンプルについて、ホイスカーの発生状況を実施例1と同様にして観察したところ、60日経過後でもホイスカーの発生は全く観察されなかった。

#### 実施例6

実施例1と同様の手順で作成した無電解錫めっき皮膜形成2層TABテストサンプルを100℃で2時間のアニーリング処理を行ない、ホイスカーの発生状況を実施例1と同様の手順で観察したところ、180日経過後でもホイスカーの発生は見られなかった。

【0037】なお、アニーリング処理後の錫めっき皮膜の膜厚は0.45μmであった。

#### 実施例7

厚さ100μmのポリイミド樹脂フィルム（宇部鉍産社製、コーピレックス-S）の片面にリソグラフィ法とエッチング法によるサブトラクティブ法によって、リード幅100μm、リードスペース幅130μm、リード厚さ35μmの銅による配線回路を形成した3層TAB

を作成し、テストサンプルとした。

【0038】上記サンプルについて実施例1と同様の手順で無電解錫めっき皮膜を形成した後、ホイスカーの発生状況を実施例1と同様の手順により観察したところ、60日経過後でもホイスカーの発生は全く見られなかった。

#### 比較例1

実施例1と同様の手順で2層TABを作成し、テストサンプルとした。

【0039】次に実施例1で用いた化学研磨液で、ドデシル硫酸ナトリウムを除いたものを用いた以外は実施例1と同様の手順で無電解錫めっき皮膜を形成した。このサンプルについて、ホイスカーの発生状況を実施例1と同様にして観察したところ、2日経過後に数本のホイスカーの発生が観察され、14日後には隣接するリードが短絡するまで成長したホイスカーが多数存在することが確認された。

#### 比較例2

実施例1と同様の手順で2層TABを作成し、テストサンプルとした。

【0040】上記サンプルを用いて、これに以下に示す手順で無電解錫めっきを施した。即ち、先ずめっき前処理として、ニュートラクリーン・7（シプレー・ファーマー・イースト社製）を用いて80℃で90秒間浸漬して、脱脂処理を行なった後、純水で洗浄した。引き続きCPB-60（三菱瓦斯化学社製）を用いて20℃で20秒間の処理を行なった。次に純水で1分間の洗浄を行なった後、10容量%の硫酸を用いて20℃で20秒間の処理を行ない、処理後この基体を乾燥させた。

【0041】その後、実施例1と同様の手順で無電解錫めっき皮膜を形成させ、めっき後処理を行なった。

【0042】上記のようにして得られたサンプルについて、実施例1と同様の手順でホイスカーの発生状況を観察したところ、翌日にはホイスカーの発生が確認され、さらに7日後には隣接するリードが短絡するまでに成長したホイスカーが多数確認された。

#### 比較例3

比較例1により作成された無電解錫めっき皮膜形成2層TABサンプルを100℃で2時間アニーリング処理を行ない、このサンプルのホイスカー発生状況を実施例1と同様の手順で観察したところ、30日経過後にはホイスカーの発生が観察され、さらに45日経過後には隣接するリードが短絡するまでに成長したホイスカーが多数確認された。

【0043】なお、アニーリング処理後の錫めっき皮膜の膜厚は0.45μmであった。

#### 【0044】

【発明の効果】以上述べたように、本発明の無電解錫めっき方法によるときは、従来錫めっき処理後に皮膜にホイスカーが発生するために、錫めっきを施した基板によって形成された配線板等の電気部品回路にはホイスカーに基づく短絡等の種々の欠陥を生ずる問題があったのを、錫めっき後のアニーリング処理によらず、本発明による錫めっき前処理を行なうことによって抑制することができ、さらにまた、これと錫めっき後のアニーリング処理とを併用することによってその効果を一層促進することができるので、特に多ピン化TABテープ等の実装における信頼性を著しく高めることができる。

## PATENT ABSTRACTS OF JAPAN

(11)Publication number : 05-148658

(43)Date of publication of application : 15. 06. 1993

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(51)Int. Cl. C23C 18/18  
C23C 18/31  
H01L 21/60  
// H05K 3/24

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## (54) ELECTROLESS TIN PLATING METHOD

## (57)Abstract:

PURPOSE: To enhance reliability in mounting a multi-pin TAB tape, etc., by treating the surface of a material to be plated with a liq. mixture of the acid, peroxide and org. high molecular compd. and then electroless-plating the material.

CONSTITUTION: Copper as a material to be plated is electroless-plated with tin. In this case, the surface of the material is treated with a liq. mixture of the acid, peroxide and org. high molecular compd., and then the material is electroless-plated. The plated material is further annealed. A soln. contg. at least one kind among sulfuric acid, hydrochloric acid, nitric acid and phosphoric acid is used as the acid. Ammonium persulfate or hydrogen peroxide is used as the peroxide. A compd. obtained by linking a straight-chain hydrocarbon or cyclic-carbon compd. to the sulfate group or phosphate group or the salt of the compd. are used as the org. compd. Consequently, any trouble is hardly caused in the electric-component circuit.

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## LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision  
of rejection]

[Kind of final disposal of application  
other than the examiner's decision of  
rejection or application converted  
registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's  
decision of rejection]

[Date of requesting appeal against  
examiner's decision of rejection]

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**CLAIMS**

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[Claim(s)]

[Claim 1] The non-electrolyzed tinning technique which uses copper as a galvanized object and is characterized by performing electroless-plating processing in the process which performs non-electrolyzed tinning after processing a galvanized object front face with the mixed liquor of an acid, a peroxide, and an organic high molecular compound.

[Claim 2] The non-electrolyzed tinning technique according to claim 1 of performing annealing processing further after carrying out electroless-plating processing of the galvanized object.

[Claim 3] The non-electrolyzed tinning technique according to claim 1 or 2 of using the solution which contains a kind of a sulfuric acid, a hydrochloric acid, a nitric acid, and the phosphoric acids, or two sorts or more as an acid.

[Claim 4] It is the non-electrolyzed tinning technique according to claim 1 or 2 of using one side of an ammonium persulfate and the hydrogen peroxides either as a peroxide.

[Claim 5] The non-electrolyzed tinning technique according to claim 1 or 2 of using the salt of the compounds which a straight chain hydrocarbon, the letter carbon compounds of cyclization, or these derivatives combined with the sulfuric-acid machine or the phosphate group as an organic high molecular compound, or these compounds.

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[Translation done.]



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DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] The non-electrolyzed tinning technique which can suppress that a whisker generates this invention in the plating side after tinning especially about the non-electrolyzed tinning processing technique in the tape carrier used for a package of IC element is offered.

[0002]

[Description of the Prior Art] In recent years, in an electronics-industry community, the development of the multirole equipment which has a low cost and high-reliability is furthered quickly, and it has high-reliability and various functions in connection with an occurrence of the high efficiency by this, and a high-density element, and lightweight and the demand to a thin small device have increased. And in connection with this, new element package ED is adding importance day by day, and the development is furthered as a technical problem with important diversification and miniaturization especially in an IC package. Moreover, the occurrence of the tape carrier of the minute pin spacing which can meet the request of the formation of many pins in a small IC package by progress of such element package technique is searched for.

[0003] TAB gives the minute lead pattern of many metals for bondings on the synthetic-resin substrate which has electric insulations, such as a polyimide-resin film formed in the shape of a tape. As the characteristic feature, since the test pad is held, before mounting the defect of poor bonding and a poor chip after bonding, it can discover. moreover, it is possible for the size of IC pad to be small, to end compared with wire bonding, and to perform much more many pins-ization -- etc. -- there are many the advantages

[0004] Although this TAB has three layer TAB in use which has the structure which stretched copper foil for adhesives to be used on a resin film now, in order to form a lead by etching, there is a limitation in performing many pins-ization indispensable to high density assembly by this three layer TAB. On the other hand, although two-layer TAB in which the direct metal layer was formed on the resin film with which the development is furthered in recent years is advantageous to the formation of many pins since a lead is formed of electroplating In order to apply optical techniques, such as the photo-lithography technique using the resist, in the process of lead formation The lead pitch which can be formed has the large place depended on the resolution of a resist, and the present condition is that the quality of the performance is left for both to etching technique and resist technical progress.

[0005] By the way, as technique of mounting TAB in IC chip, the so-called gag bonding method which piles up and carries out thermocompression bonding of the lead of TAB on the bump formed beforehand is common for IC chip, and it can be said that it is efficient and TAB is excellent in a package of IC chip also in this point compared with the wire-bonding method conventionally applied to bondings, such as a leadframe.

[0006] Although the optimum technique plates with gold also at the copper lead by the side of TAB in order to raise bond strength, since [ to require ] the bump formed in IC chip was usually formed by gold, recently, tinning is used as a golden alternative from the cost-problem. It is because fully

reliable bond strength will be obtained since an eutectic alloy is produced into this fraction when thermocompression bonding of the tin formed in the lead of TAB and the gold of the bump of IC chip is carried out in order that tin may form gold and an eutectic if it becomes what.

[0007] As the technique of forming the plating coat of tin on a copper lead, although there are electric tinning technique and the non-electrolyzed tinning technique, generally the non-electrolyzed tinning technique is used rather than the electric tinning technique from relations, such as connection of the pattern of a lead, and dispersion of plating thickness.

[0008]

[Problem(s) to be Solved by the Invention] although it is efficiently [ cost-wise / tinning / and ] useful as one of TAB formation techniques for IC package as described above, the needlelike excrescence (henceforth a whisker) which boils occasionally on the tinning coat formed on copper, carries out, and is mostly called a whisker perpendicularly to a coat occurs Once it generates, this whisker will grow with time and will grow up to be even millimeters [ several / a maximum of ] order. As a general trend, the edge or corner of a processed material has much location which this whisker generates, and it is generated by TAB. [ to an inner lead ] [ many ] In future package technique, high-density-ization by the formation of many pins progresses further, and since it being further made detailed and becoming micrometers [ some dozens of ] order is expected, the inner lead pitch of TAB has large possibility of generating the defective by the shunt of the lead which adjoined easily by growth of the above-mentioned whisker.

[0009] Now, there is no suitable technique of canceling occurrence of this whisker. The study from the standpoint of a plating liquid improvement, although the study from the standpoint of the plating after-treatment technique is made -- yet -- deciding -- \*\* -- the technique of becoming not being found out, but, although the combined use with the annealing method for heat-treating after tinning and the technique of holding at this and low temperature further is performed as a countermeasure over whisker occurrence Even if it makes it what \*\*, such technique is extracted to how the latent period to whisker occurrence is extended, and has not become a radical cure.

[0010] this invention is faced solving the above-mentioned trouble in tinning processing, and performing non-electrolyzed tinning processing, and it aims at offering the non-electrolyzed tinning technique which can suppress occurrence of a whisker completely.

[0011]

[Means for Solving the Problem] After this invention for attaining the above-mentioned technical problem facing copper as a galvanized object performing non-electrolyzed tinning to this and processing a galvanized object front face with the mixed liquor of an acid, a peroxide, and an organic high molecular compound, it is characterized by performing electroless-plating processing.

[0012] Moreover, after performing the above-mentioned processing, it includes performing annealing processing in a galvanized object further.

[0013] As an acid used in case of non-electrolyzed tinning processing in this invention It is desirable that it is a solution containing a kind of a sulfuric acid, a hydrochloric acid, a nitric acid, and the phosphoric acids or two sorts or more. It is desirable to use one side. moreover -- peroxide \*\*\*\*\* -- either an ammonium persulfate or the hydrogen peroxides -- It is desirable to use the salt of the compounds which a straight chain hydrocarbon, the letter carbon compounds of cyclization, or these derivatives combined with the sulfuric-acid machine or the phosphate group as an organic high molecular compound further again, or these compounds.

[0014]

[Function] Next, the detail of this invention and an operation are explained.

[0015] The precipitation of the principle of electroless plating is enabled by adding the compound of a certain kind as for which the tin which originally cannot be separated from the relation of electrode potential on copper can reduce copper electrode potential rather than the electrode potential of tin into plating liquid.

[0016] As this kind of a compound, thiourea is used widely. Therefore, a precipitation of a up to [ the

copper of tin ] is a substitution reaction, and affecting a copper surface state and the property of the tin which microscopic granularity put is fully considered.

[0017] Moreover, although various views are one of the causes which a whisker generates in tinning and the essential cause is not checked now, the opinion to which it be supposed that it is based on copper residual stress is the most leading opinion. There are many views that the annealing [ which suppresses generation of a whisker ] method which it is the simplest and is heated several hours at 90-120 degrees C after tinning as the high technique of an effect is the optimum, and it is also the technique of supporting the above-mentioned residual-stress theory. However, even when the above-mentioned heating technique is adopted, even if it is possible, it cannot extinguish suppressing whisker occurrence completely.

[0018] Generally, the location which a whisker tends to generate is the corner at the nose of cam of a lead in what has a detailed circuit like TAB. From this, a whisker can consider that the occurrence is influenced also in the shape of [ of a covering object ] surface type. It is thought that that it is easy to generate a whisker in the corner at the nose of cam of a lead originates in the irregularity of the front face of a covering object when it sees microscopically, and if the front face of a covering object is smooth, it will have suggested that occurrence of a whisker can be suppressed a certain degree. That is, it is considered to be effective as a means to suppress occurrence of a whisker whether the front face of a covering object is made by processing before performing tinning, and to make it smooth.

[0019] Usually, before surely performing plating processing by every wet plating technique, physical in a galvanized object and operation in which a chemical preparation performs the defecation of the front face are made. Generally these processings are called head end process, and they are performed in order to raise the adhesion and the appearance of a plating coat and a material which were acquired.

[0020] It is divided roughly into the activation process for removing the oxide film currently formed on the degreasing process for removing the fats and oils which have adhered to the function of pretreatment on a galvanized field, and the galvanized field. The technique using the electrolytic decomposition process other than the technique according [ the former degreasing process ] to the organic solvent is adopted. The technique of using mineral acids, such as the technique of removing an oxide film every material using the solution which can melt a galvanized object about the latter, and a sulfuric acid, a nitric acid, and removing an oxide film, or the technique of performing by using these both together is common.

[0021] Also in the non-electrolyzed tinning technique, not an exception but the above-mentioned degreasing process and the activation process are adopted as pretreatment. However, a copper front face will usually be split-face-ized inevitably [ before performing this process after performing this activation process, since an activation process is the technique of removing an oxide film by melting the oxide film of a galvanized object, i.e., a copper front face, ]. This is exactly becoming the inclination which promotes occurrence of a whisker, judging from the reason mentioned above.

[0022] In this invention, it succeeds in attaining smoothing on the front face of copper after processing by adding an organic high molecular compound in the liquid for activation processing. Thus, it is presumed that a copper front face carries out smoothing by adding an organic high molecular compound in an activation processing solution because this organic high molecular compound will show the work which the concavity on the front face of copper is adsorbed, and delays lysis of the fraction to a heights and will ease the microscopic irregularity on the front face of copper as a result, if an organic high molecular compound exists in this solution.

[0023] It turns out that the compound having the functional group which has hydrophobic properties, such as a functional-group straight chain-like carbon compound which has hydrophilic properties, such as a sulfuric-acid machine or a phosphate group, as structure of an organic high molecular compound which shows such an operation, or a letter carbon compound of cyclization, is desirable. In this invention, although the organic high molecular compound described above in the solution used as polishing liquid is melted and it uses in fact in case activation processing is performed, as for the concentration, the effect is fully acquired at about several percent with a weight. Moreover, about the

processing time, although it does not change with the case where it processes with the activation solution which does not usually contain an organic high molecular compound, it is the most desirable to set, after checking the surface state after processing in real operation.

[0024] Moreover, after doing in this way and performing data smoothing, even if it performs activation processing by the mineral acid etc. continuously further, the effect of this invention does not change.

[0025] Moreover, although it is natural, when performing annealing processing to a substrate at the temperature near after [ non-electrolyzed tinning coat formation ] 100 degree C, the effect of this invention can be promoted much more.

[0026]

[Example] The example of this invention is explained below.

The thing in which the 1-micrometer copper coat was formed on the top of the polyimide-resin film (Toray Industries and the Du Pont make, Kapton 200H) which is 50 micrometers was made into the base, and example 1 thickness created two-layer TAB which used together the lithography method and the semi additive process by electroplating on this base top, and formed the wiring circuit by copper with the lead width of face of 100 micrometers, a lead space width of face [ of 130 micrometers ], and a lead thickness of 30 micrometers in it, and made

[0027] Non-electrolyzed tinning was performed in the procedure shown below using the above-mentioned sample. plating pretreatment \*\*\*\*\* -- first -- Max -- clean -- after were immersed for 20 seconds at 20 degrees C using BEG-306 (product made from \*\*\*\*\*) and performing degreasing processing, the pure water performed washing for 1 minute, and processing for 20 seconds was succeedingly performed at 20 degrees C using the mixed solution which consists of a 5g [l. ] ammonium persulfate, a 20ml [l. ] sulfuric acid, and a 1g [l. ] sodium dodecyl sulfate

[0028] Next, after a pure water performed washing for 1 minute, the 10 capacity % sulfuric acid was used for the pan, processing for 20 seconds was performed at 20 degrees C, and the base was dried.

[0029] As non-electrolyzed tinning processing, it is Tinposit. Processing for 5 minutes was performed at 70 degrees C using LT-34 (\*\*\*\*\* Far East company make), and the pure water performed washing for 1 minute. Thus, the thickness of the obtained tinning coat was about 0.6 micrometers.

[0030] When the sample obtained in the above-mentioned procedure was left in the atmospheric air and the occurrence status of a whisker was observed with the metaloscope (one 200 times the scale factor of this), occurrence of a whisker was not observed at all after 60 day progress.

Two-layer TAB was created in the same procedure as example 2 example 1, and it considered as the test sample.

[0031] Next, the non-electrolyzed tinning coat was formed in the same procedure as an example 1 except having changed [ l. ] the concentration of a sodium dodecyl sulfate in 0.5g /with the chemical-polishing liquid used in the example 1.

[0032] When the occurrence status of a whisker was observed like the example 1 about this sample, occurrence of a whisker was not observed at all after 60 day progress.

Two-layer TAB was created in the same procedure as example 3 example 1, and it considered as the test sample.

[0033] Next, the non-electrolyzed tinning coat was formed in the same procedure as an example 1 except having changed [ l. ] the concentration of a sodium dodecyl sulfate in 1.5g /with the chemical-polishing liquid used in the example 1.

[0034] When the occurrence status of a whisker was observed like the example 1 about this sample, occurrence of a whisker was not observed at all after 60 day progress.

Two-layer TAB was created in the same procedure as example 4 example 1, and it considered as the test sample.

[0035] Next, the non-electrolyzed tinning coat was formed in the same procedure as an example 1 except having changed to the sodium dodecyl sulfate with the chemical-polishing liquid used in the example 1, and having used 1 and 5-naphtha range sulfonic-acid disodium by the concentration of 1g/l.

When the occurrence status of a whisker was observed like the example 1 about this sample, occurrence of a whisker was not observed at all after 60 day progress.

Two-layer TAB was created in the same procedure as example 5 example 1, and it considered as the test sample.

[0036] Next, the non-electrolyzed tinning coat was formed in the same procedure as an example 1 except having changed to the sodium dodecyl sulfate with the chemical-polishing liquid used in the example 1, and having used the 2-naphthylamine-1-sulfonic acid by the concentration of 1g/l. When the occurrence status of a whisker was observed like the example 1 about this sample, occurrence of a whisker was not observed at all after 60 day progress.

When annealing processing of 2 hours was performed for the non-electrolyzed tinning coat formation two-layer TAB test sample created in the same procedure as example 6 example 1 at 100 degrees C and the occurrence status of a whisker was observed in the same procedure as an example 1, occurrence of a whisker was not seen after 180 day progress.

[0037] In addition, the thickness of the tinning coat after annealing processing was 0.45 micrometers. With the subtractive process by the lithography method and the etching method, three layer TAB in which the wiring circuit by copper with the lead width of face of 100 micrometers, a lead space width of face [ of 130 micrometers ], and a lead thickness of 35 micrometers was formed was created on one side of a polyimide-resin film (the Ube mineral product company make, \*\*\*\*\*-S) with an example 7 thickness of 100 micrometers, and it considered as the test sample at it.

[0038] After forming a non-electrolyzed tinning coat in the procedure same about the above-mentioned sample as an example 1, when the occurrence status of a whisker was observed with the same procedure as an example 1, occurrence of a whisker was not seen at all after 60 day progress. Two-layer TAB was created in the same procedure as example of comparison 1 example 1, and it considered as the test sample.

[0039] Next, the non-electrolyzed tinning coat was formed in the same procedure as an example 1 except having used the thing except the sodium dodecyl sulfate with the chemical-polishing liquid used in the example 1. It was checked that many whiskers which grew until the lead which occurrence of the whisker of several is observed after two day progress, and will adjoin 14 days after connected too hastily, when the occurrence status of a whisker was observed like the example 1 about this sample exist.

Two-layer TAB was created in the same procedure as example of comparison 2 example 1, and it considered as the test sample.

[0040] Non-electrolyzed tinning was performed to this in the procedure shown below using the above-mentioned sample. namely, -- first -- plating pretreatment \*\*\*\*\* -- truck the nu -- the pure water washed, after were immersed for 90 seconds at 80 degrees C using 7 (\*\*\*\*\* Far East company make) and performing degreasing processing, clean and Processing for 20 seconds was succeedingly performed at 20 degrees C using CPB-60 (Mitsubishi Gas Chemical Co., Inc. make). Next, after a pure water performed washing for 1 minute, processing for 20 seconds was performed at 20 degrees C using the sulfuric acid of 10 capacity %, and this base was dried after processing.

[0041] Then, the non-electrolyzed tinning coat was made to form in the same procedure as an example 1, and plating after treatment was performed.

[0042] When the occurrence status of a whisker was observed in the same procedure as an example 1 about the sample obtained as mentioned above, occurrence of a whisker was checked at the next day and many whiskers which grew by the time the lead which will adjoin seven days after connected with the pan too hastily were checked.

When annealing processing was performed for the non-electrolyzed tinning coat formation two-layer TAB sample created by the example 1 of example of comparison 3 comparison at 100 degrees C for 2 hours and the whisker occurrence status of this sample was observed in the same procedure as an example 1, occurrence of a whisker was observed after 30 day progress, and many whiskers which grew by the time the lead which adjoins after 45 day progress connected with the pan too hastily were

checked.

[0043] In addition, the thickness of the tinning coat after annealing processing was 0.45 micrometers.

[0044]

[Effect of the Invention] Like, when [ which was described above ] based on the non-electrolyzed tinning technique of this invention That the problem which produces the various defects of a simplistic grade based on a whisker was in electrical-part circuits, such as a patchboard formed of the substrate which performed tinning, in order that a whisker might occur in a coat after tinning processing conventionally It cannot be based on annealing processing after tinning, but can suppress by performing tinning pretreatment by this invention. Since the effect can be promoted much more by using together this and annealing processing after tinning further again, the reliability in a package of a many pins-sized TAB tape etc. can be raised especially remarkably.

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[Translation done.]